US005280945A

United States Patent [19]

Delbeke

[11] Patent Number: 5,280,945

[45] Date of Patent: Jan. 25, 1994

[54] **UPPER CONTROL ARM FOR VEHICLE SUSPENSION SYSTEM**

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[21] Appl. No.: **958,854**

[22] Filed: **Oct. 7, 1992**

[51] **Int. Cl.**[5] **B60G 7/00**
[52] **U.S. Cl.** **280/673**; 29/897.2
[58] **Field of Search** 280/663, 673, 675, 688, 280/690, 691; 52/731; 29/897.2; 267/228

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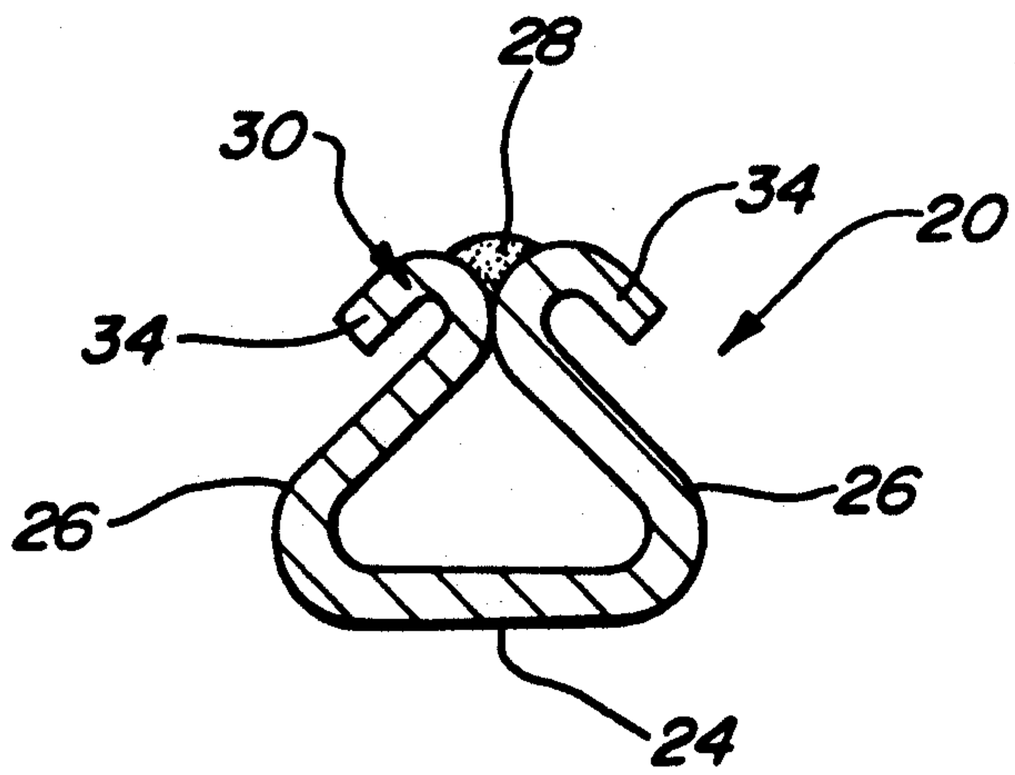
[57] **ABSTRACT**

An upper control arm for a vehicle suspension system having a modulus section of hollow construction for reduced weight. The modulus section of the control arm is of a stamped and welded construction thereby eliminating material weight while reducing the cost of manufacturing. The modulus section has a substantially triangular configuration with a reinforced rim flange along the high compression stress area of the control arm elbow. The reinforced rim flange improves the strength of the control arm without sacrificing the weight reduction provided by the hollow construction. The present invention incorporates a deep rim flange section along the elbows of the control arms and shallower rim flanges along the remainder to improve strength without sacrificing weight or dimension.

5 Claims, 1 Drawing Sheet



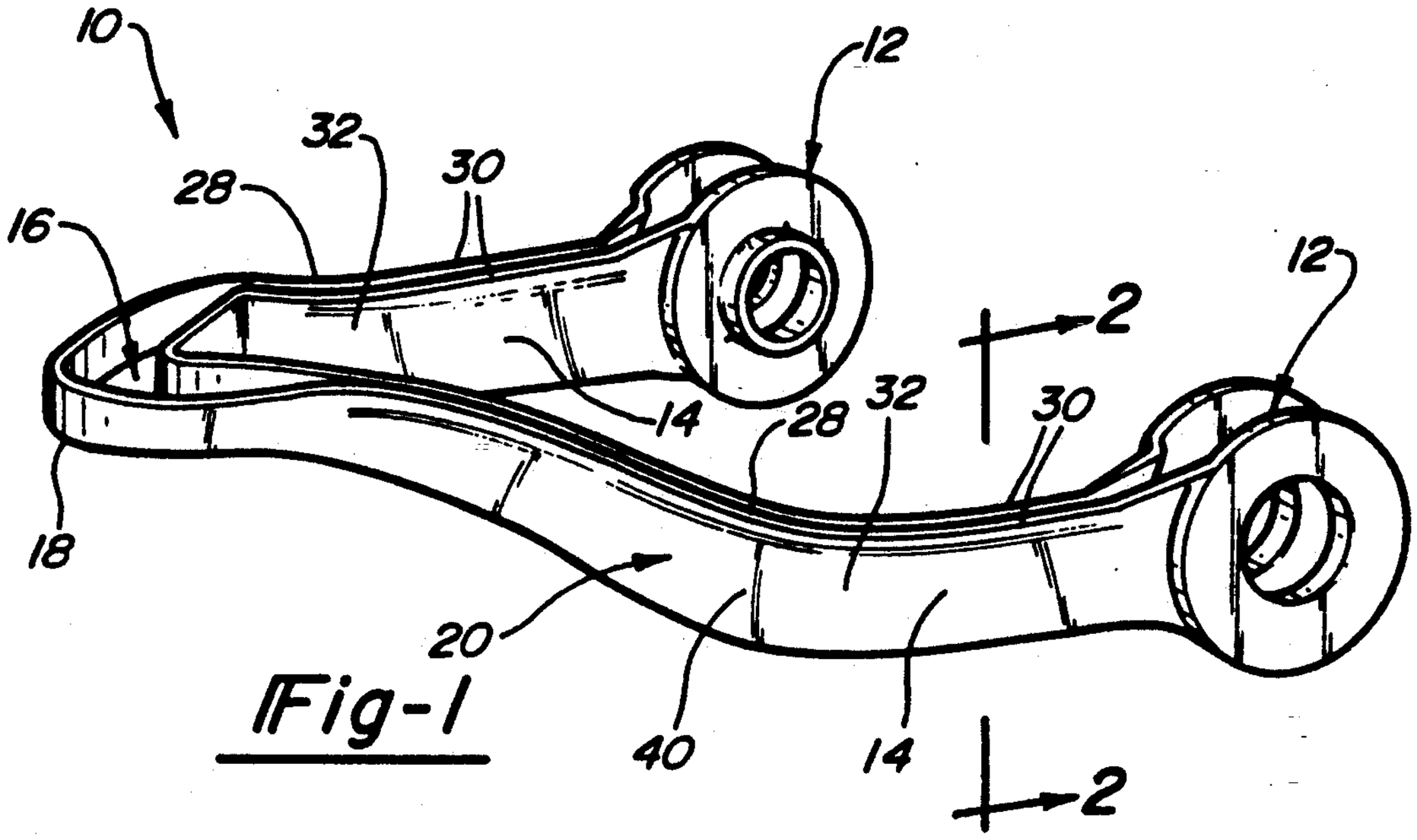


Fig-1

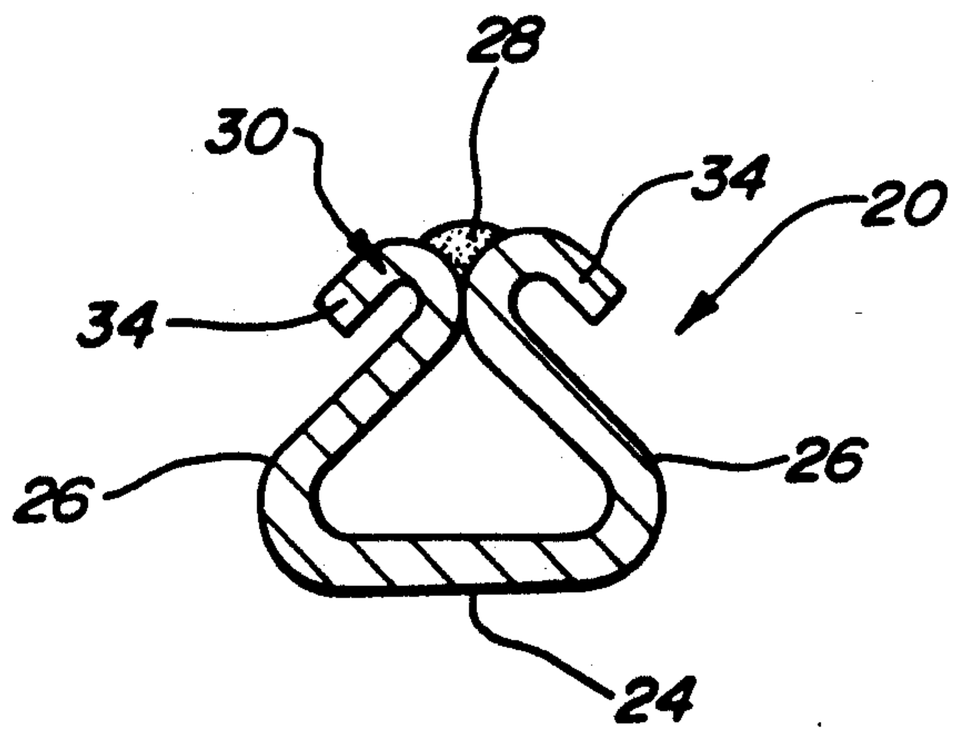


Fig-2

UPPER CONTROL ARM FOR VEHICLE SUSPENSION SYSTEM

BACKGROUND OF THE INVENTION

I. Field of the Invention

This invention relates to an upper control arm for a vehicle suspension system and, in particular, to a control arm having a modulus section of hollow construction with an enlarged rim flange for reinforcement of high load stress areas of the control arm yet maintains the height integrity of the control arm.

II. Description of the Prior Art

Upper control arms are routinely incorporated into the suspension systems of truck and passenger vehicles. The typical control arm is generally U-shaped with a ball joint assembly at the apex of the control arm and pivot bar bushings at the ends of the arm for mounting the control arm to a pivot bar assembly. In the past, the modulus sections between the bushings and the ball joint have been solid sections of cast iron or cast aluminum. It was believed that the traditional cast metal sections were necessary to maintain the integrity of the control arm under the stresses of the suspension system. More recently, the modulus section has been constructed of a steel forging of wire frame design. Although these control arm constructions were strong enough to withstand the stress loads they also were very heavy. In today's vehicle market every aspect of a vehicle is examined for weight reduction.

Recent proposals for reducing the weight of the suspension system include a hollow, two-piece control arm. The square hollow bar section comprises a pair of U-shaped components nested together and double seam welded. Thus, the control arm has double side walls with single upper and lower walls. Although strong and lightweight, the double side walls are not located at the compressive stress areas of the arm where additional strength is required. Moreover, the double seam construction requires precise welding over a curving contour which has not been easy to accommodate. Nevertheless, substantial weight reduction over the solid cross-section of the prior known control arms has been accomplished.

SUMMARY OF THE PRESENT INVENTION

The present invention overcomes the disadvantages of the prior known control arms for vehicle suspension systems by incorporating a modulus section of hollow construction having a substantially triangular configuration in order to distribute the compressive stress loads associated with the suspension system. An enlarged rim flange at the joint apex of the stamped triangular construction provides improved reinforcement at the high compression stress areas of modulus section.

Typical of control arms, the present invention has a substantially U-shaped configuration with a ball joint assembly at the apex and pivot bar bushings at the ends of the control arm. However, the control arm of the present invention includes a modulus section having a substantially triangular hollow cross-section which reduces the overall weight of the control arm while maintaining strength in key stress areas of the elbow sections. The hollow triangular sections are formed through a stamping process wherein the upper apex of the modulus section incorporates a seam weld to form the triangular cross-section. For increased stiffening and reinforcement, an enlarged rim flange is formed along the welded apex seam. This rim flange along the high compression stress areas of the control arm elbow eliminates stress failures along this area and permits double plate FEA modeling resulting in additional load balancing capabilities. The rim flange is preferably bent downward parallel to the sides of the triangular section whereby the length of the flange may be increased without sacrificing the height dimensions of the arm.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be more fully understood by reference to the following detailed description of a preferred embodiment of the present invention when read in conjunction with the accompanying drawing, in which like reference characters refer to like parts throughout the views and in which:

FIG. 1 is an elevated perspective view of a upper control arm for a vehicle suspension system embodying the present invention; and

FIG. 2 is a cross-sectional view of the control arm taken along lines 2—2 of FIG. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE PRESENT INVENTION

Referring to FIGS. 1 and 2, there is shown elevational and cross-sectional views of a control arm 10 embodying the principles of the present invention. The control arm 10 is preferably an upper control arm forming a part of a suspension system of a vehicle. As is typical of such components, the control arm 10 has a substantially U-shaped configuration with bushing apertures 12 formed at the ends of the arms 14 and a ball joint receptacle 16 formed at the apex 18 of the control arm 10. The ball joint receptacle 16 is adapted to cooperate with a ball joint assembly (not shown) and may include a ball joint housing integrally formed with the control arm 10. Typical modern control arms 10 incorporate a separate ball joint housing which is inserted into the apex 18 of the control arm 10. The bushing apertures 12 are designed to retain pipe bushings (not shown) for mating engagement with a pivot bar assembly forming a portion of the vehicle suspension system. The pivot bar typically extends through both bushing apertures 12 allowing the control arm 10 to pivot about the assembly in response to road conditions affecting the vehicle suspension system.

The control arm 10 of the present invention is formed of an integral metal stamping to ensure the required structural strength for the suspension system. However, unlike the prior known control arms which incorporate a solid construction, the present invention comprises hollow modulus sections 20 for weight reduction. The control arm 10 includes modulus sections 20 along each arm 14 between the apex 18 and the bushing apertures 12. These modulus sections 20 are subject to extreme compression and tension loads and therefore must have sufficient structural strength to withstand such loads particularly along the bends or "elbows" of the arms 20. In order to maintain the structural strength while providing substantial weight reduction, the modulus sections 20 of the control arm 10 of the present invention are provided with a hollow, substantially triangular cross-sectional configuration as best shown in FIG. 2. It

has been found that this triangular configuration provides improved strength against the loads while also providing a uniform weld line over the contours of the modulus sections **20** facilitating programmable welding of the seam **28** along the modulus sections **20**.

The modulus sections **20** of the control arm **10** include a bottom wall **24** and a pair of side walls **26** which are bent into mutual contact to form the triangular configuration. An upper seam **28** is formed at the contact point which is welded to maintain the integrity of the modulus sections **20**. Extending outwardly from the welded upper seam **28** is a reinforcement rim flange **30**. The rim flange **30** improves the structural strength of the modulus sections **20** particularly the high compression load areas **32** at the bends in the control arm **10**. The rim flange **30** is formed by integral extensions **34** of the side walls **26**. The rim flange **30** has a stiffening effect on the hollow modulus sections **20** of the control arm **10**. In the preferred embodiment of the present invention the integral extensions **34** which form the rim flange **30** are bent downwardly substantially parallel to the side walls **26** of the hollow triangular modulus sections **20**. By bending the rim flange **30** downward the practical length of the flange is increased thereby adding strength yet the height integrity of the modulus section **20** is maintained allowing the control arm **10** to be positioned within the vehicle. The rim flange **30** does not increase the height of the section **20** beyond the seam **22** but adds substantially to the support strength of the control arm **10**. Furthermore, by limiting the extended rim flange **30** to only the deep central elbow area **40** of the control arm **10** and utilizing a more natural rim flange outside of the area **40** the overall weight is kept to a minimum while strength is substantially improved. Thus, the hollow, substantially triangular modulus sections **20** provide a substantial reduction in weight and cost of manufacturing without sacrificing the structural strength necessary to maintain the integrity of the control arms **10** of the vehicle suspension system.

The foregoing detailed description has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom as some modifications will be obvious to those skilled in the art without departing from the scope and spirit of the appended claims.

What is claimed is:

1. A control arm for a vehicle suspension system adapted to be connected to a ball joint assembly and a pivot bar assembly, said control arm comprising:

an integral body having a substantially U-shaped configuration with means for receiving the ball joint assembly at a bight of said body and means for receiving the pivot bar assembly at remote ends of said body;

said integral body having a modulus sections along each arm intermediate said bight and the end of said arm, said modulus sections having a hollow, substantially triangular cross-sectional configuration with a seam formed by joining two walls of said triangular modulus section, said modulus sections including a reinforcement rim flange for improved rigidity along said modulus sections, said rim flange being an extension of said joined walls extending outwardly from said seam and substantially parallel to said joined walls of said triangular modulus section.

2. The control arm as defined in claim **1** wherein said rim flange is an extension of said joined walls of said triangular modulus section and including a deep rim flange along a central elbow portion of said modulus section and shallow rim flanges along outer portions of aid modulus section.

3. The control arm as defined in claim **2** wherein said extension of said joined walls extends downwardly from said welded seam substantially parallel to said joined walls of said triangular modulus section to form said deep rim flange.

4. A control arm for a vehicle suspension system adapted to be connected to a ball joint assembly and a pivot bar assembly, said control arm comprising:

an integral body having a substantially U-shaped configuration with means for receiving the ball joint assembly at a light of said body and means for receiving the pivot bar assembly at the ends of said body;

said integral body having modular sections along each arm, said modulus sections having a hollow, substantially triangular cross-sectional configuration, with an upper seam along the top apex of said triangular modulus sections formed by joining two walls of said triangular modulus section, said upper seam including a reinforcement rim flange formed as an extension of said joined walls, said joined walls extending downwardly from said seam and substantially parallel to said side walls of said triangular modulus section.

5. The control arm as defined in claim **4** wherein said triangular modulus sections of said control arm are of an integral, one-piece stamped construction with opposing edges joined to form said triangular cross-sectional configuration.

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